Stoller
Hanford Office

DOE-EM/GJ825-2005

C4175
Log Data Report

Borehole Information:

Borehole: C4175			**Site:** 216-T-28 Crib		
Coordinates (WA State Plane)		**GWL (ft)[1]:** Dry		**GWL Date:** 12/04	
North	**East**	**Drill Date**	**TOC[2] Elevation**	**Total Depth (ft)**	**Type**
Not available	Not available	12/04	Not available	225	Cable

Casing Information:

Casing Type	Stickup (ft)	Outer Diameter (in.)	Inside Diameter (in.)	Thickness (in.)	Top (ft)	Bottom (ft)
Threaded steel	0.0	10 13/16	9 5/8	19/32	0.0	65
Threaded Steel	2.2	8 5/8	7 5/8	1/2	0	225

Borehole Notes:

The logging engineer used a steel tape to measure the casing diameters from casing nearby the drill rig. All logging measurements are referenced to ground surface.

Logging Equipment Information:

Logging System:	Gamma 1E		**Type:** SGLS (70%) 34TP40587A
Calibration Date:	10/04	**Calibration Reference:**	DOE-EM/GJ770-2004
		Logging Procedure:	MAC-HGLP 1.6.5, Rev. 0

Logging System:	Gamma 1C		**Type:** HRLS planar 39A314
Calibration Date:	05/04	**Calibration Reference:**	DOE-EM/GJ713-2004
		Logging Procedure:	MAC-HGLP 1.6.5, Rev. 0

Spectral Gamma Logging System (SGLS) Log Run Information:

Log Run	1	2	3	4 Repeat	5
Date	11/08/04	11/08/04	11/08/04	11/08/04	12/06/04
Logging Engineer	Spatz	Spatz	Spatz	Spatz	Spatz
Start Depth (ft)	65.5	35.5	6.5	64.5	64.5
Finish Depth (ft)	34.5	5.5	0.5	54.5	224.5
Count Time (sec)	100	20	100	100	100
Live/Real	R	R	R	R	R
Shield (Y/N)	N	N	N	N	N
MSA Interval (ft)	1.0	1.0	1.0	1.0	1.0
ft/min	N/A[3]	N/A	N/A	N/A	N/A
Pre-Verification	AE022CAB	AE022CAB	AE022CAB	AE022CAB	AE033CAB
Start File	AE022000	AE022032	AE022063	AE022070	AE033000

Log Run	1	2	3	4 Repeat	5
Finish File	AE022031	AE022062	AE022069	AE022079	AE033160
Post-Verification	AE022CAA	AE022CAA	AE022CAA	AE022CAA	AE033CAA
Depth Return Error (in.)	N/A	N/A	0	0	N/A
Comments	No fine-gain adjustment.	No fine-gain adjustment.	No fine-gain adjustment.	No fine-gain adjustment.	No fine-gain adjustment.

Log Run	6 Repeat				
Date	12/06/04				
Logging Engineer	Spatz				
Start Depth (ft)	100.5				
Finish Depth (ft)	116.5				
Count Time (sec)	100				
Live/Real	R				
Shield (Y/N)	N				
MSA Interval (ft)	1.0				
ft/min	N/A				
Pre-Verification	AE033CAB				
Start File	AE033161				
Finish File	AE033177				
Post-Verification	AE033CAA				
Depth Return Error (in.)	- 1				
Comments	No fine-gain adjustment.				

High Rate Logging System (HRLS) Log Run Information:

Log Run	7	8	9	10	11 Repeat
Date	12/10/04	12/13/04	12/13/04	12/13/04	12/13/04
Logging Engineer	Spatz	Spatz	Spatz	Spatz	Spatz
Start Depth (ft)	35.5	29.5	7.5	21.5	20.5
Finish Depth (ft)	28.5	6.5	6.5	10.5	12.5
Count Time (sec)	300	100	300	100	100
Live/Real	R	R	R	R	R
Shield (Y/N)	N	N	N	Y (internal)	Y (internal)
MSA Interval (ft)	1.0	1.0	1.0	1.0	1.0
ft/min	N/A	N/A	N/A	N/A	N/A
Pre-Verification	AC113CAB	AC114CAB	AC114CAB	AC114CAB	AC114CAB
Start File	AC113000	AC114000	AC114024	AC114026	AC114038
Finish File	AC113007	AC114023	AC114025	AC114037	AC114046
Post-Verification	AC113CAA	AC114CAA	AC114CAA	AC114CAA	AC114CAA
Depth Return Error (in.)	0	N/A	0	N/A	0
Comments	Fine-gain adjustment after file 02.	No fine-gain adjustment.	No fine-gain adjustment.	No fine-gain adjustment.	No fine-gain adjustment.

Logging Operation Notes:

Logging was performed with a centralizer installed on the sondes. Pre- and post-survey verification measurements for the SGLS employed the Amersham KUT (^{40}K, ^{238}U, and ^{232}Th) verifier with serial number 118. A high rate interval from 5.5 to 35.5 ft was logged with the SGLS at a 20-sec count time.

High rate logging was performed from 6.5 to 35.5 ft. An internal tungsten shield was used from 10.5 to 21.5 ft (log runs 10 and 11) in the depth interval of highest gamma activity. The pre- and post-verification measurements were acquired in the CS-137 verifier, SN 1013.

Analysis Notes:

Analyst:	Henwood	**Date:**	02/01/05	**Reference:**	GJO-HGLP 1.6.3, Rev. 0

SGLS and HRLS pre-run and post-run verification spectra were collected at the beginning and end of the day. All of the verification spectra were within the acceptance criteria. Examinations of spectra indicate that the detector functioned normally during logging, and the spectra are accepted.

Log spectra were processed in batch mode using APTEC SUPERVISOR to identify individual energy peaks and determine count rates. Verification spectra were used to determine the energy and resolution calibration for processing the data using APTEC SUPERVISOR. Concentrations for SGLS and HRLS spectra were calculated in EXCEL (source files: G1EOct04.xls and G1cMay04.xls, respectively). Logging was conducted in a single casing string for each log run. A correction for a 0.5937-in.-thick casing was applied to the SGLS and HRLS data acquired between the ground surface and 65 ft. Below 65 ft, a 0.5-in.-thick casing correction was applied to the SGLS data. Dead time corrections are applied to the SGLS data where dead time exceeds 6.4 percent. Where SGLS dead time exceeds 40 percent, HRLS data are substituted. Where dead time for the HRLS exceeds 40 percent, data are acquired with an internal shield on the HRLS. No water corrections were required.

Log Plot Notes:

Separate log plots are provided for gross gamma and dead time, naturally occurring radionuclides (^{40}K, ^{238}U, and ^{232}Th), and man-made radionuclides. Plots of the repeat logs versus the original logs are included. For each radionuclide, the energy value of the spectral peak used for quantification is indicated. Unless otherwise noted, all radionuclides are plotted in picocuries per gram (pCi/g). The open circles indicate the minimum detectable level (MDL) for each radionuclide. Error bars on each plot represent error associated with counting statistics only and do not include errors associated with the inverse efficiency function, dead time correction, or casing correction. These errors are discussed in the calibration report. A combination plot is included to facilitate correlation. The ^{214}Bi peak at 1764 keV was used to determine the naturally occurring ^{238}U concentrations on the combination plot rather than the ^{214}Bi peak at 609 keV because it exhibited slightly higher net counts per second.

Results and Interpretations:

^{137}Cs, ^{60}Co, and ^{154}Eu were the man-made radionuclides detected in this borehole. ^{137}Cs was detected from the ground surface to 70 ft and at a few sporadic locations below 70 ft to total depth. A maximum concentration of approximately 3.9 E 06 pCi/g was measured at 17.5 ft.

^{60}Co was detected from 35 to 83 ft and at 110.5 ft. The maximum concentration was approximately 0.9 pCi/g at 37.5 ft. It is likely ^{60}Co exists in the high gamma activity zone between 10 and 35 ft. The MDL for ^{60}Co is significantly increased in the high activity zone such that it may not be detected.

^{154}Eu was detected from 35 to 111 ft and at 117.5 ft. The maximum concentration was measured at approximately 110 pCi/g at 80.5 ft. It is likely ^{154}Eu exists in the high gamma activity zone between 10 and 35 ft. The MDL for ^{154}Eu is significantly increased in the high activity zone such that it may not be detected.

The ^{40}K and ^{232}Th logs show some variations in concentrations suggesting lithology changes that may be correlated with adjacent boreholes. Log data acquired on 12/06/04 show enhanced radon in the borehole between 65 and 225 ft in depth.

The plots of the repeat logs demonstrate reasonable repeatability of the SGLS data for the natural and man-made radionuclides.

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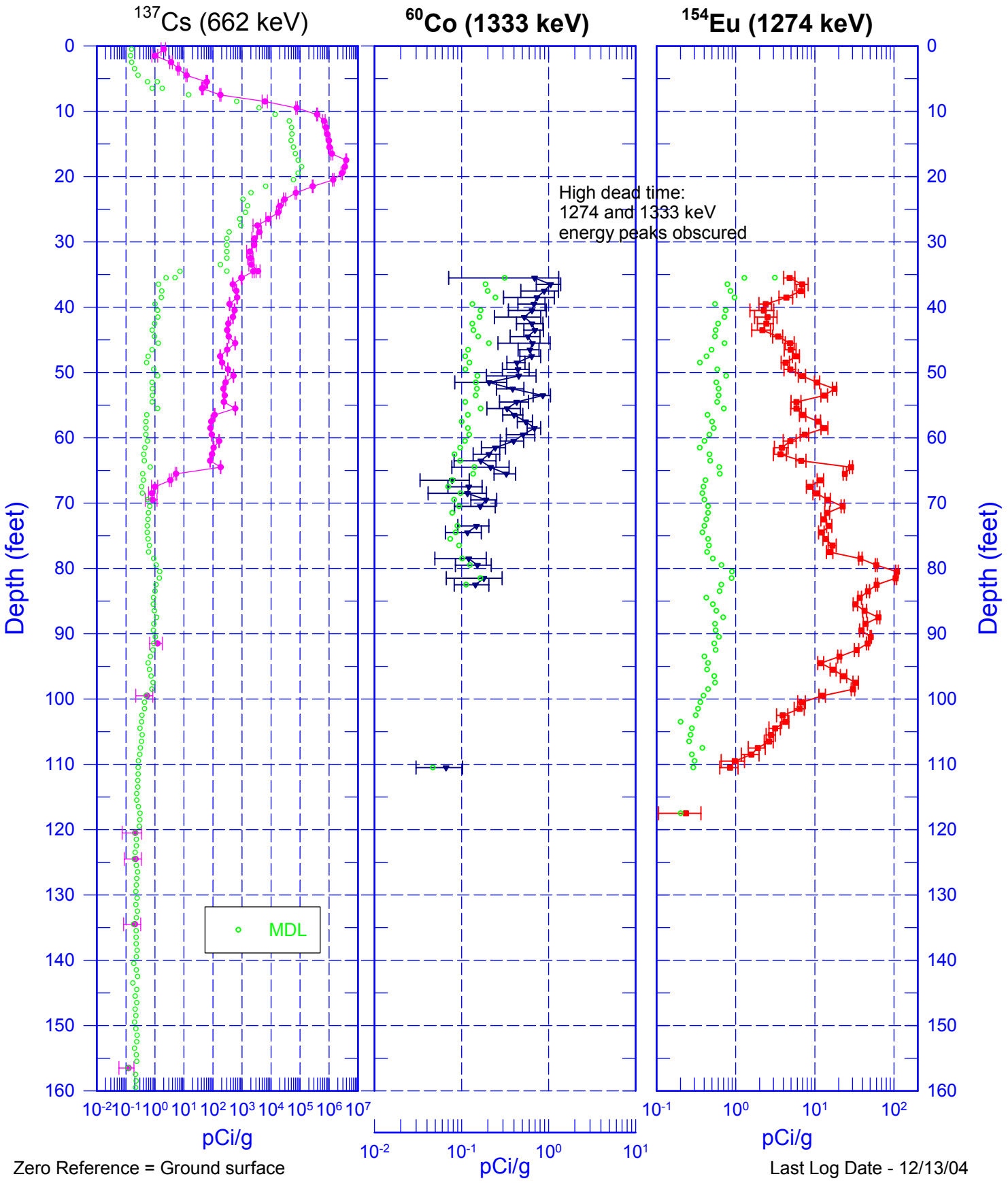
[1] GWL – groundwater level
[2] TOC – top of casing
[3] N/A – not applicable

C4175
Man-Made Radionuclides



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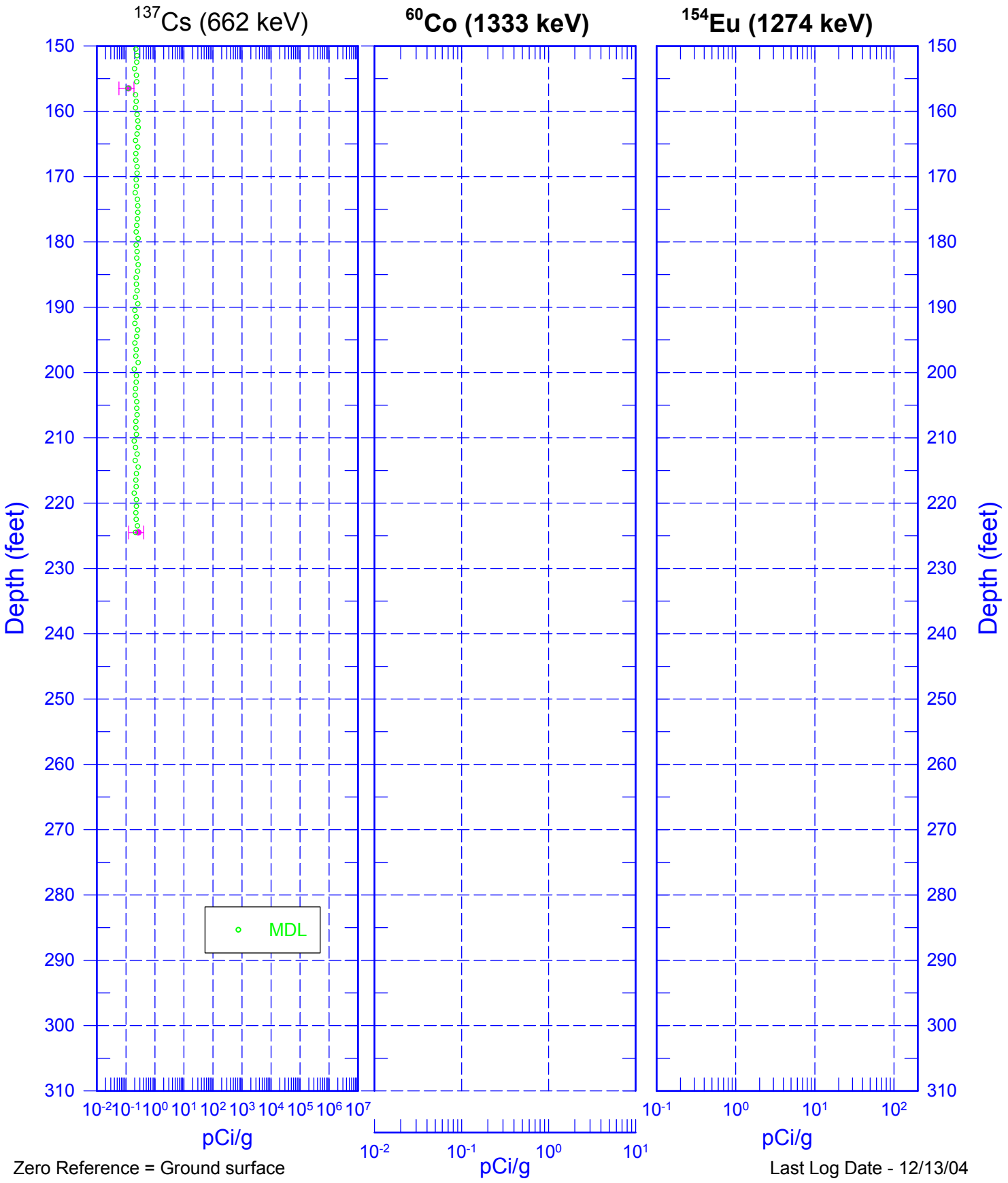
Man-Made Radionuclides



Zero Reference = Ground surface

Last Log Date - 12/13/04

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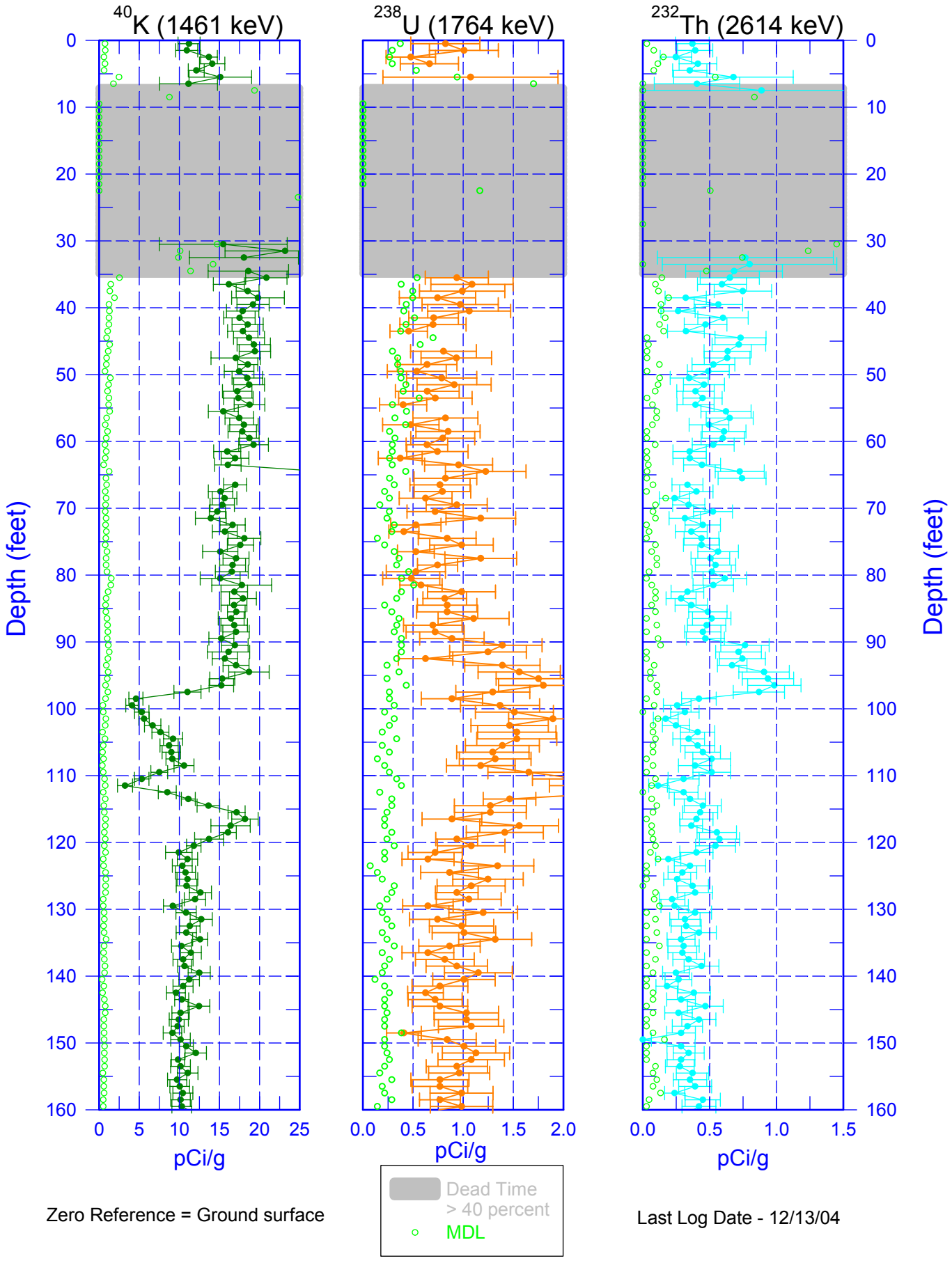
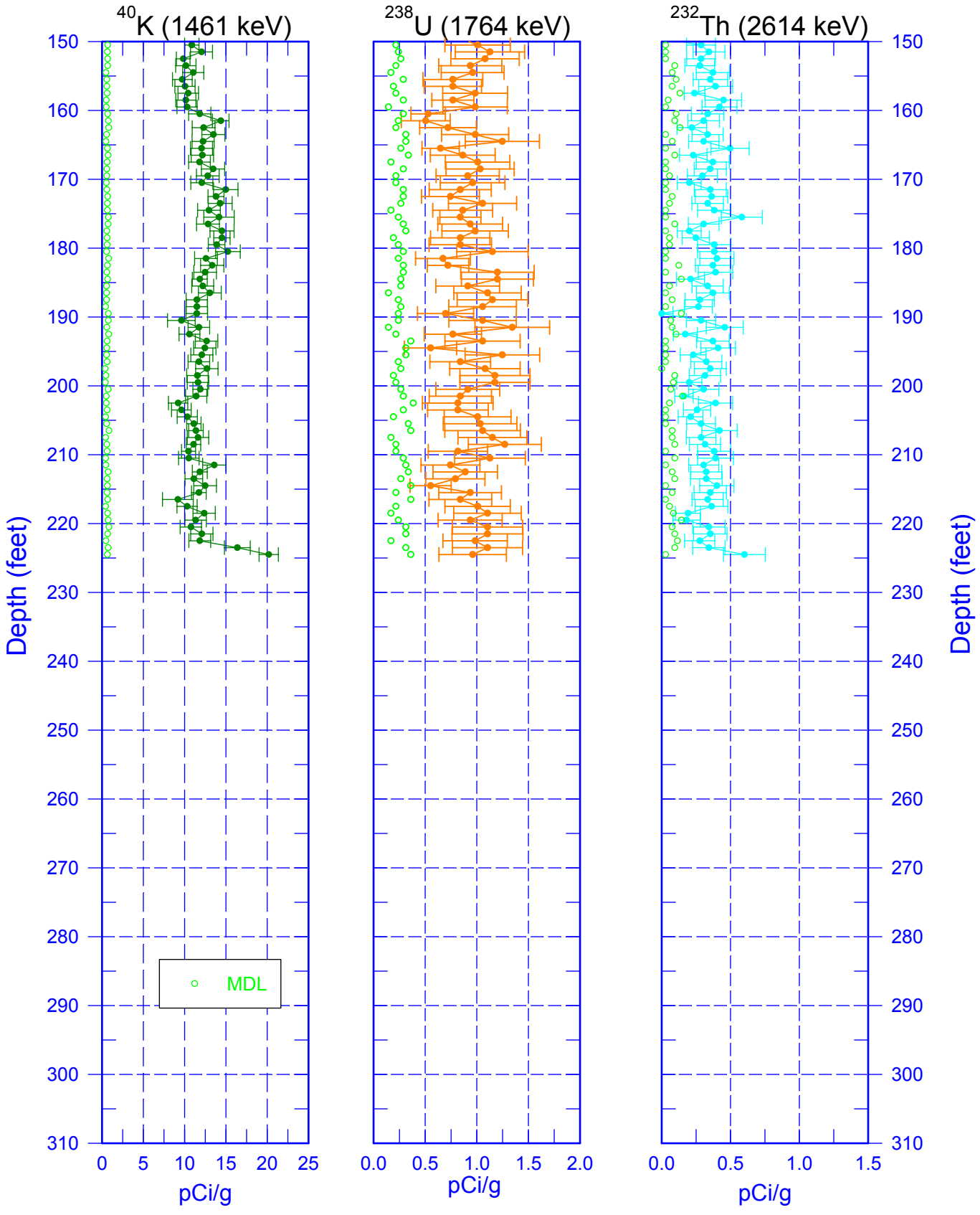
Natural Gamma Logs



Zero Reference = Ground surface

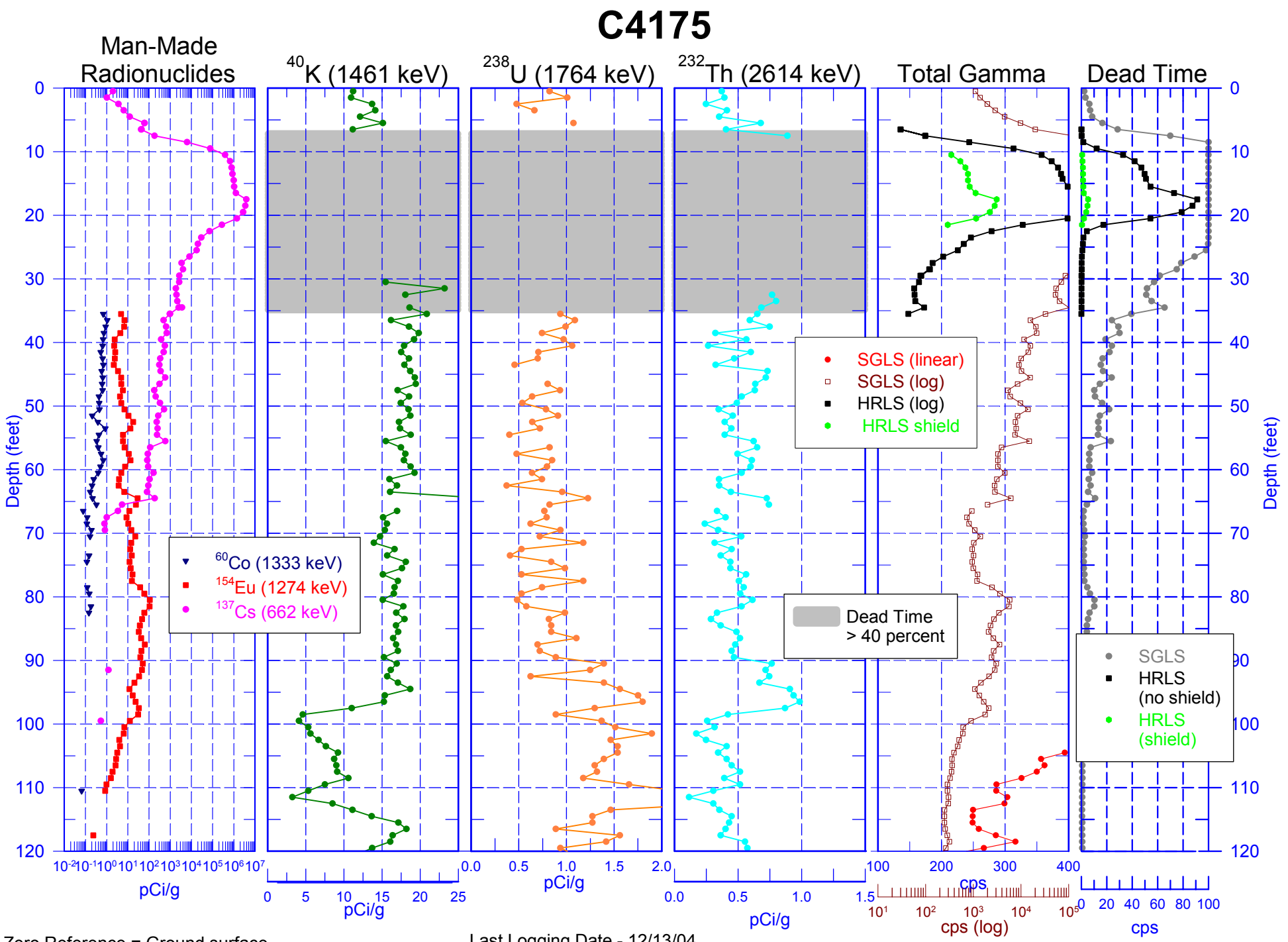
Last Log Date - 12/13/04

C4175
Natural Gamma Logs



Zero Reference = Ground surface

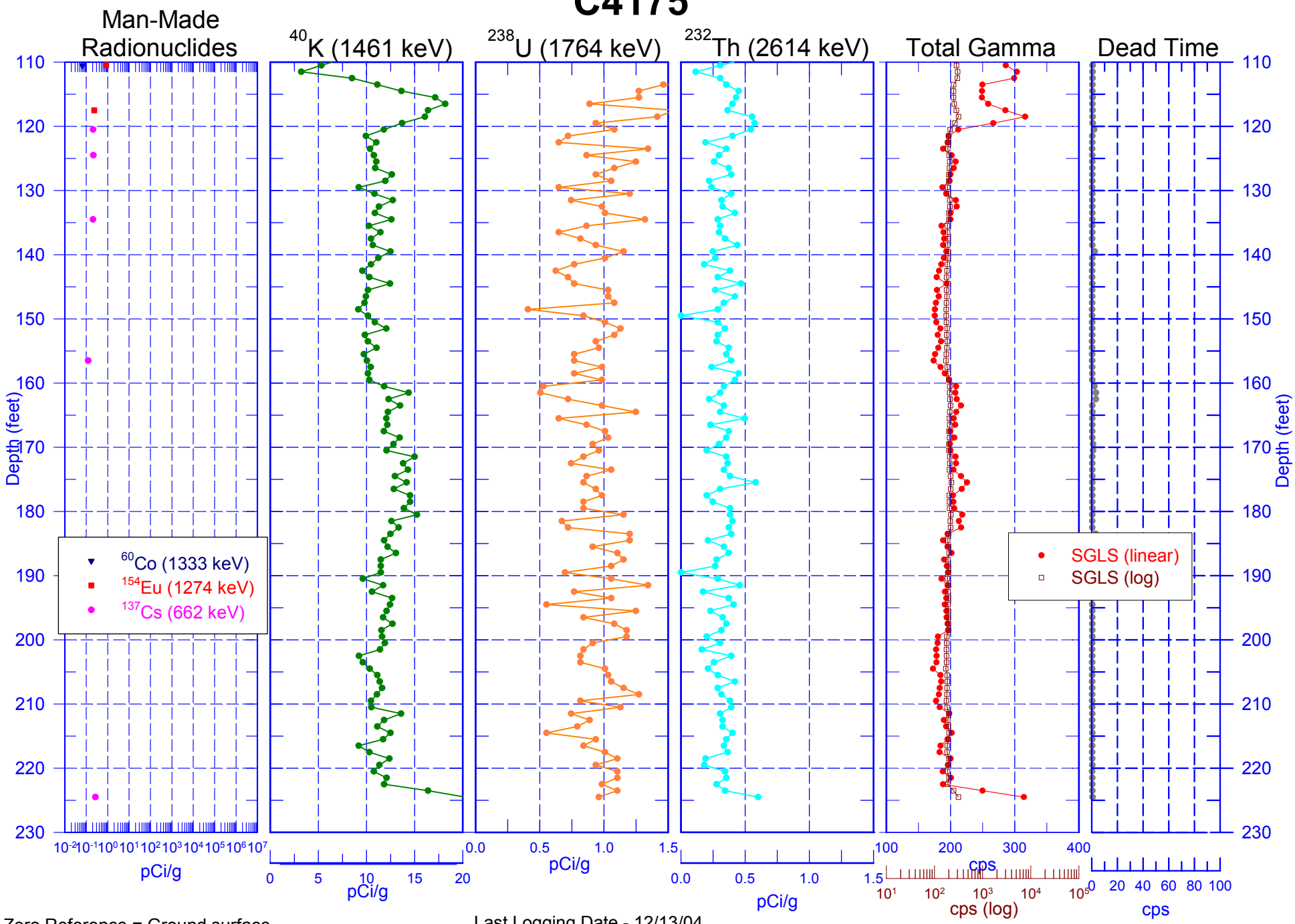
Last Log Date - 12/13/04



Zero Reference = Ground surface

Last Logging Date - 12/13/04

C4175



Zero Reference = Ground surface

Last Logging Date - 12/13/04

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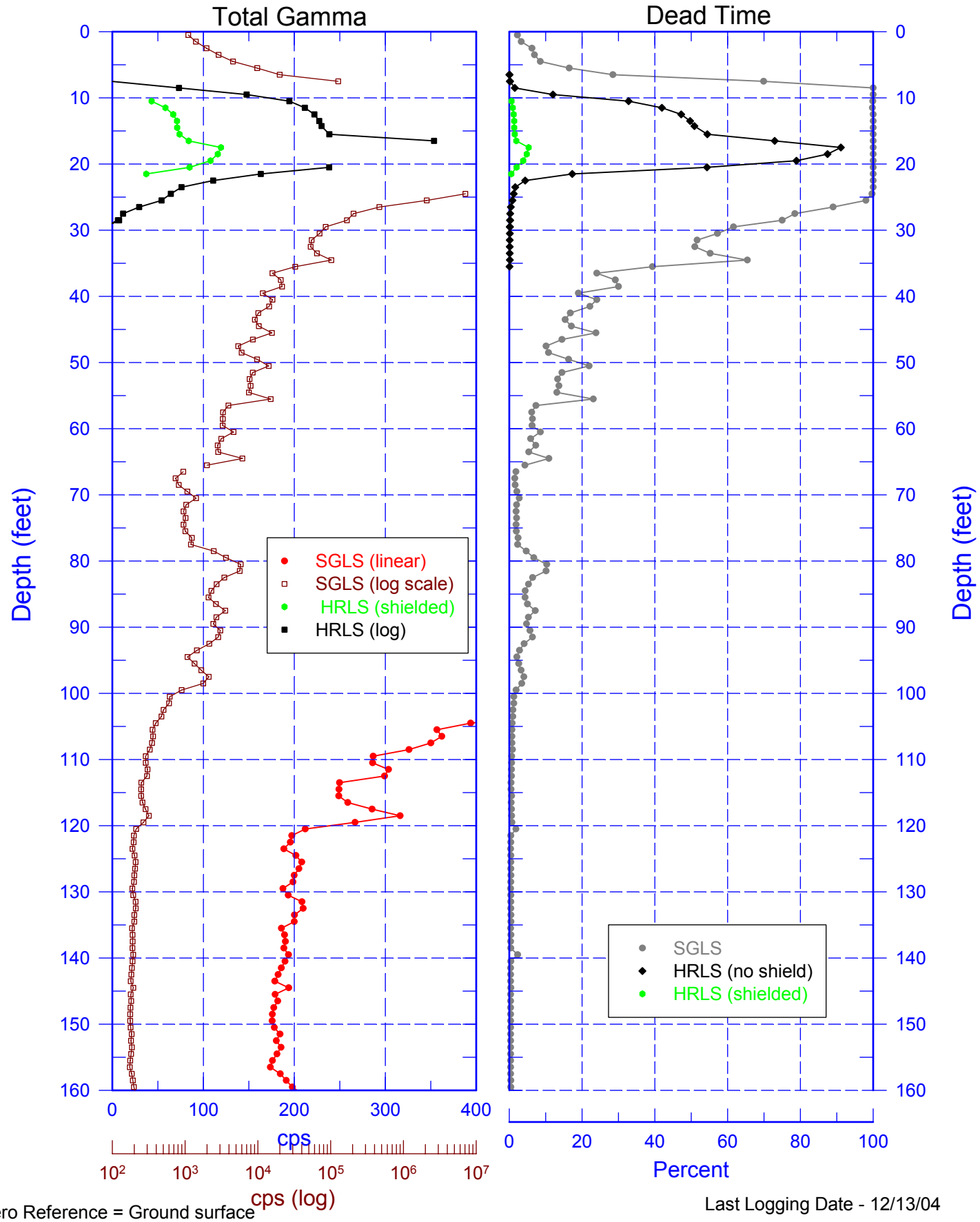
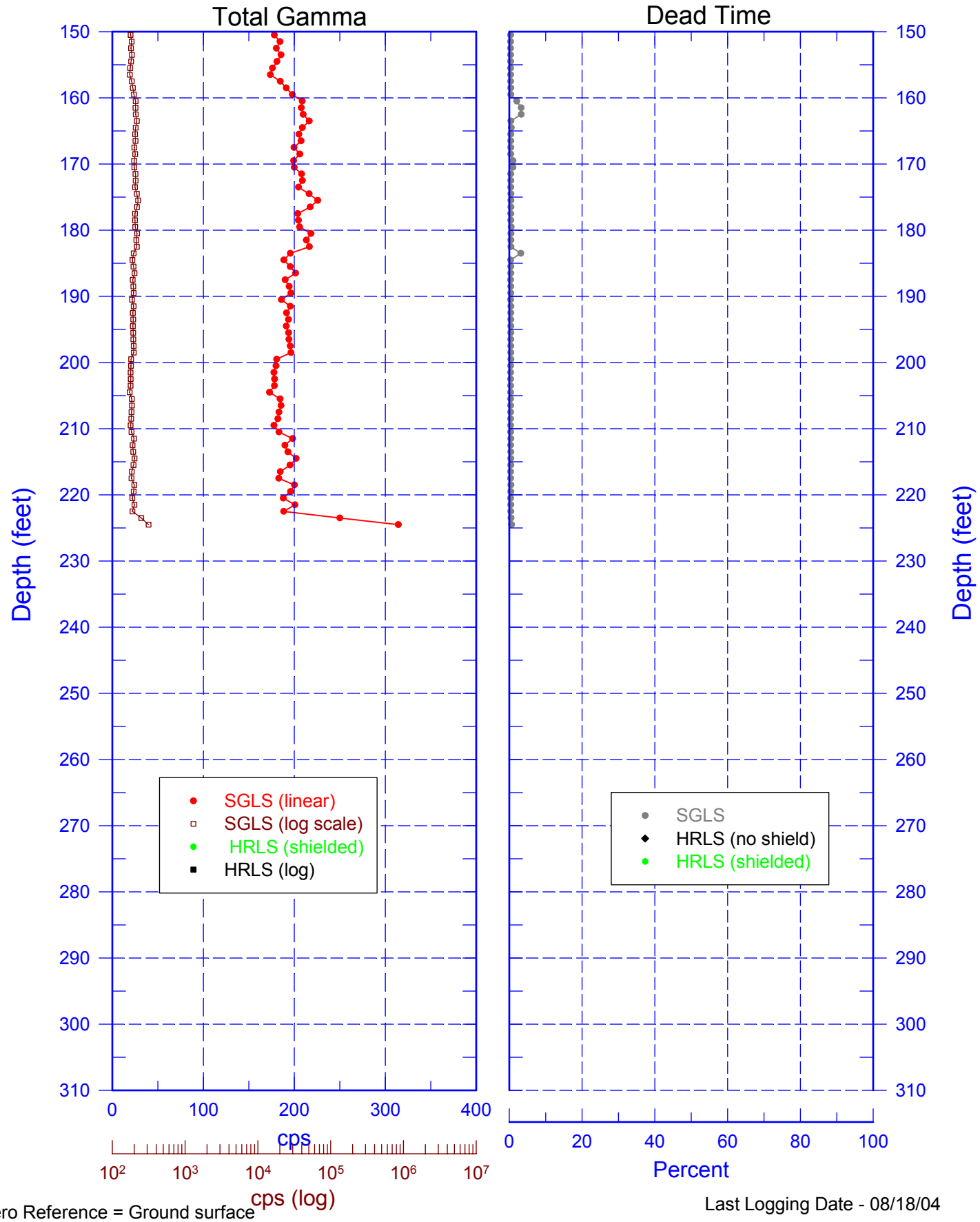
Total Gamma & Dead Time



Zero Reference = Ground surface

Last Logging Date - 12/13/04

C4175
Total Gamma & Dead Time



Zero Reference = Ground surface

Last Logging Date - 08/18/04

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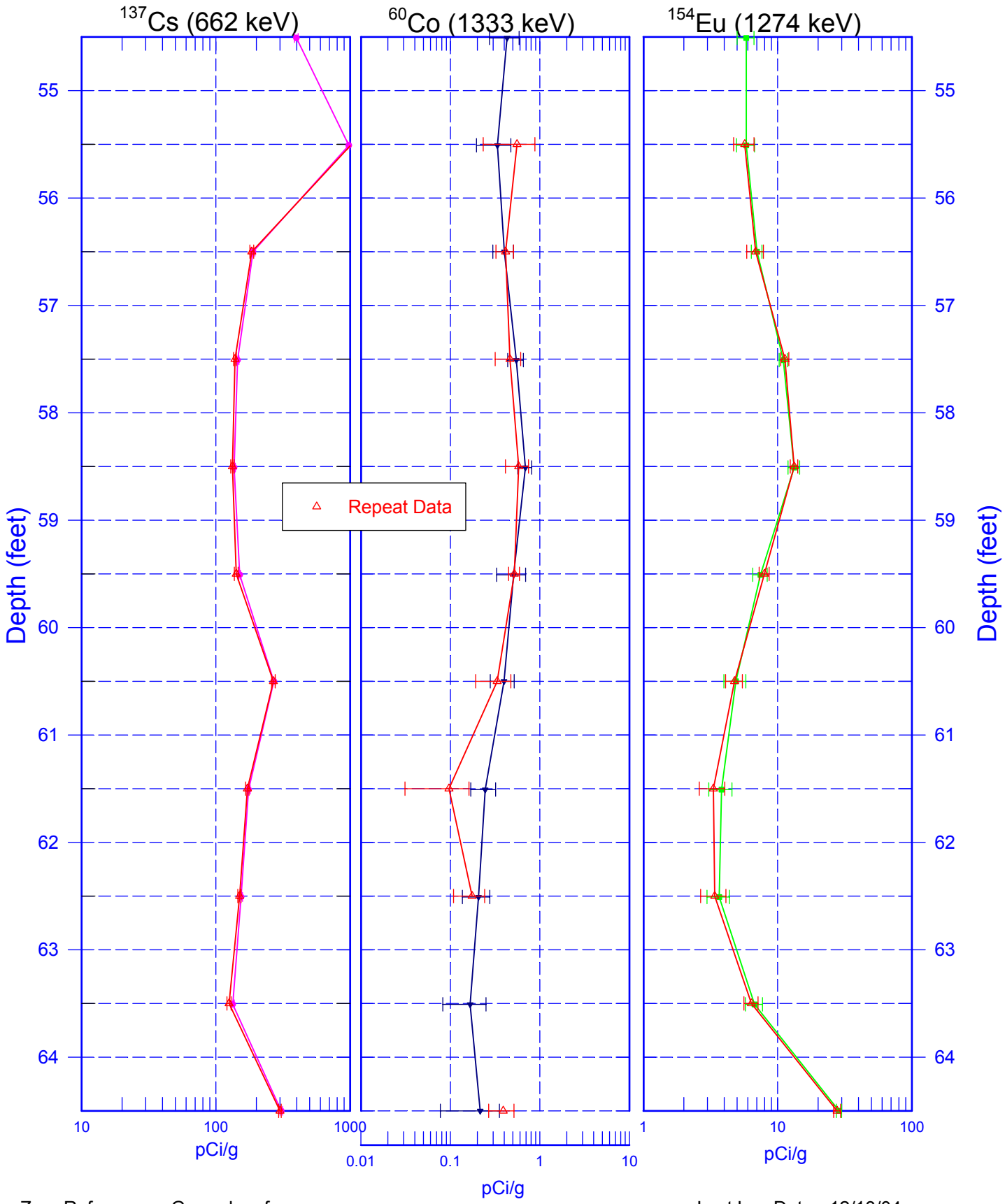
Repeat Section of Man-Made Radionuclides



Zero Reference = Ground surface

Last Log Date - 12/13/04

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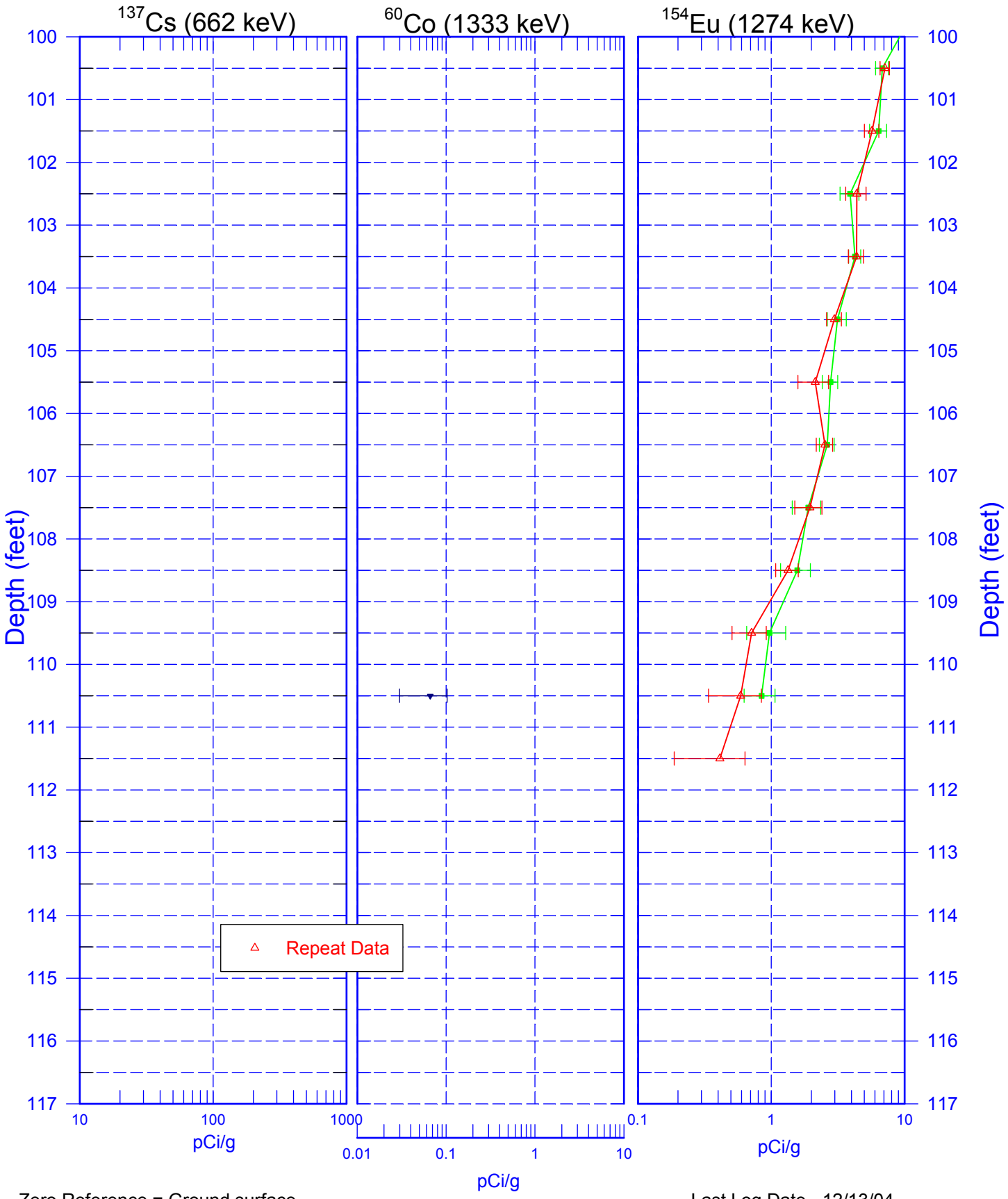
Repeat Section of Man-Made Radionuclides



Zero Reference = Ground surface

Last Log Date - 12/13/04

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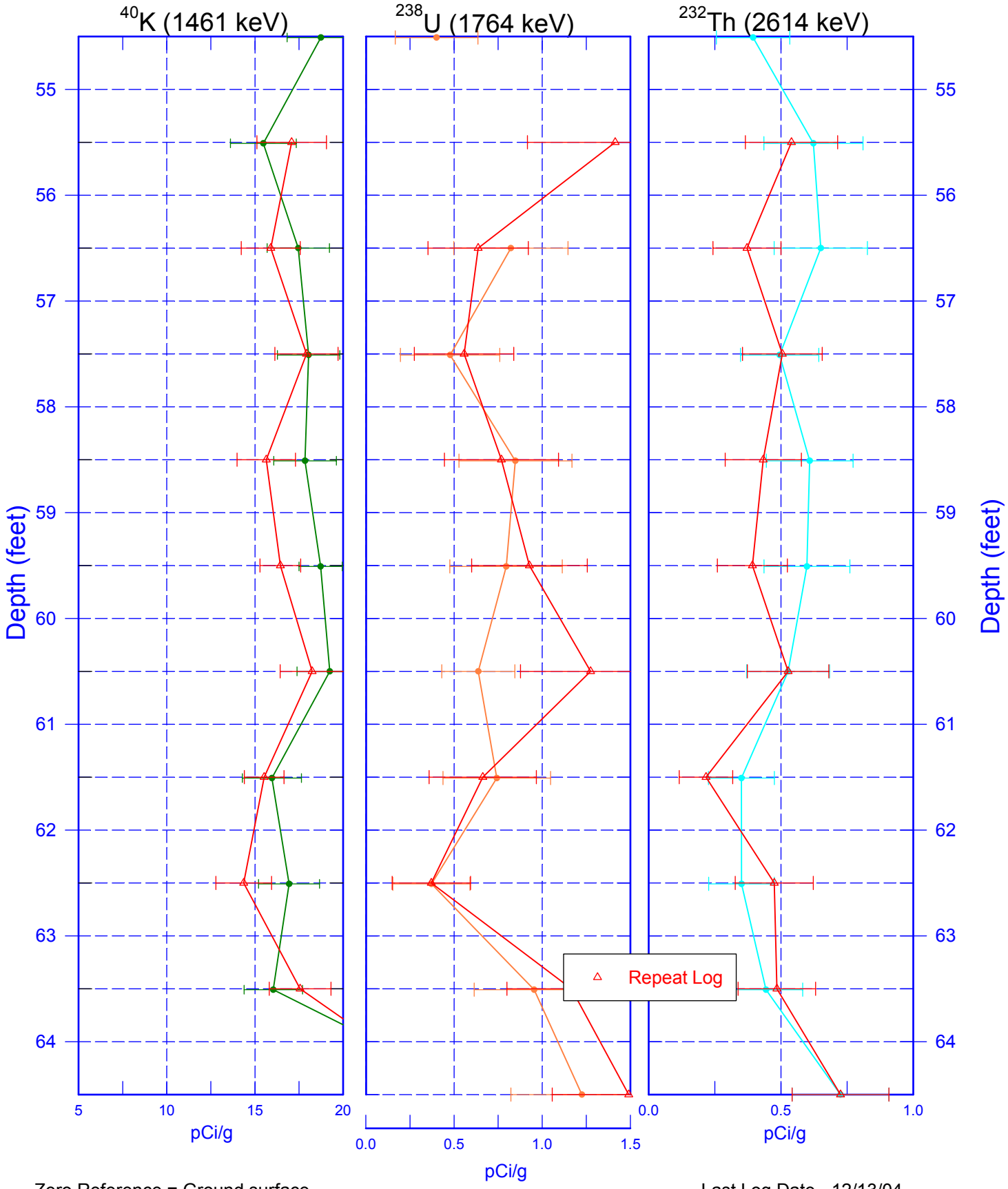
Repeat Section of Natural Gamma Logs



Zero Reference = Ground surface

Last Log Date - 12/13/04

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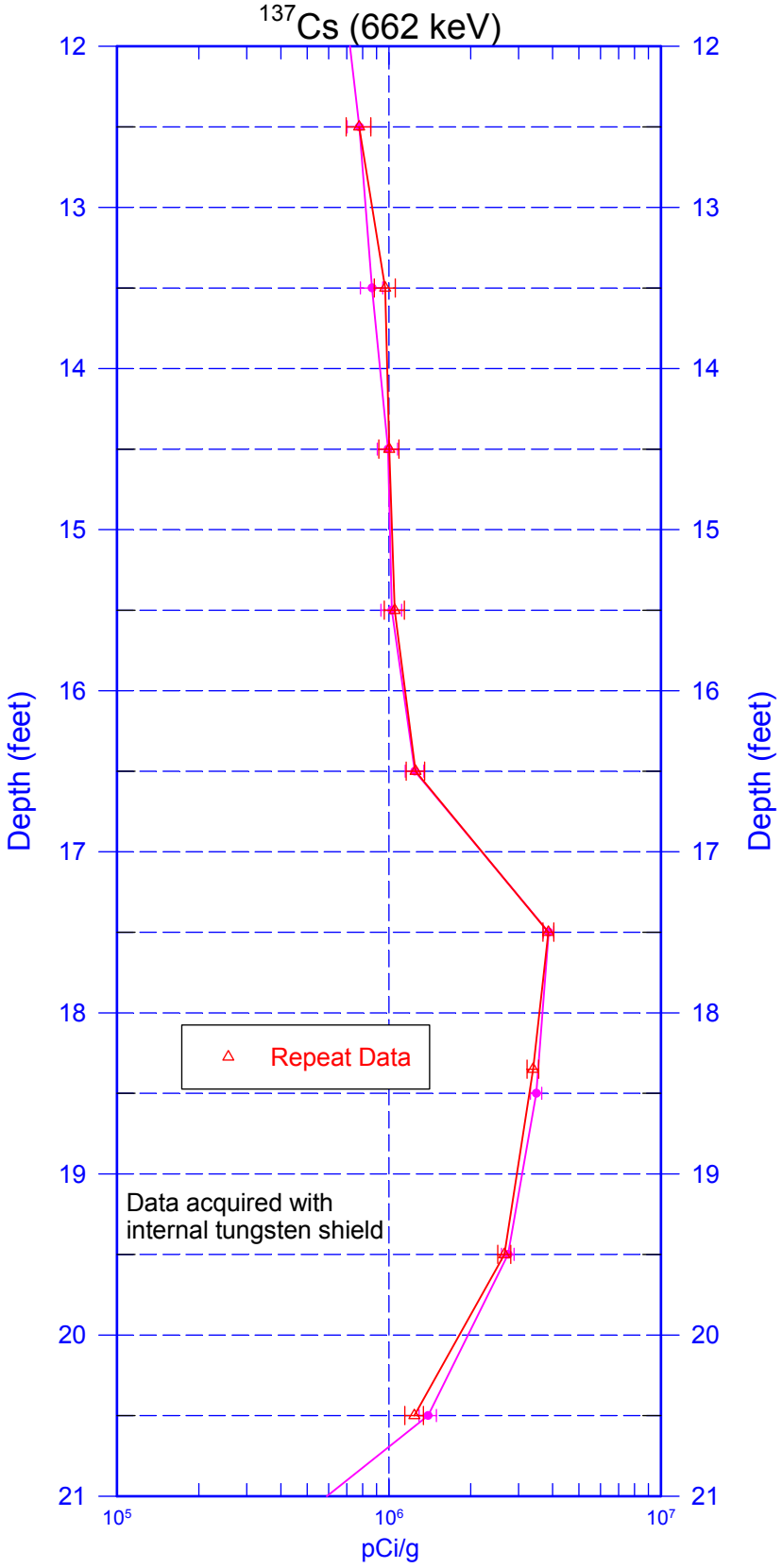
Repeat Section of High Rate (Internal Shield)



Zero Reference = Ground surface

Last Log Date - 12/13/04